

# *THE HUMAN EFFECTIVENESS DIRECTORATE*

## **USA Human Factor Helicopter Mishap Findings and Recommendations**

By

**Colonel Pete Mapes, USAF, MC, CFS**



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# Statement of Accountability



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# Background



- This study describes all 251 U.S. Army Class A-B Rotary Wing Mishaps ascribed to 'Human Factors' from FY 85 to 05
- This data is based on a study of data archived in the mishap files of the USA Combat Readiness Center at Fort Rucker, Alabama
- This data is the second part of a study that will include all rotary wing aircraft in the DoD
- The first part 'USAF Helicopter Mishap Data' was publicly released on 18 Sep 2006





# Method



- Obtained all U.S. Army Rotary Wing Aircraft Class A & B Mishaps ascribed to 'Human Factors' from FY 85 to FY 05 inclusive from the U.S. Army Readiness Center
- Reviewed all 251 mishap reports on 278 helicopters
- Created a data base for initial analysis
- No monetary value is associated with fatalities
- Major injuries resulted in approximately four weeks or more of lost duty time
- Minor injuries resulted in approximately less than four weeks of lost duty time





# Outline



- Characterize the force
- Identify major areas of lethality, injury and airframe loss
- Identify injury patterns
- Categorize mishaps by phase of flight
- Summarize mishaps by airframe
- Formulate recommendations



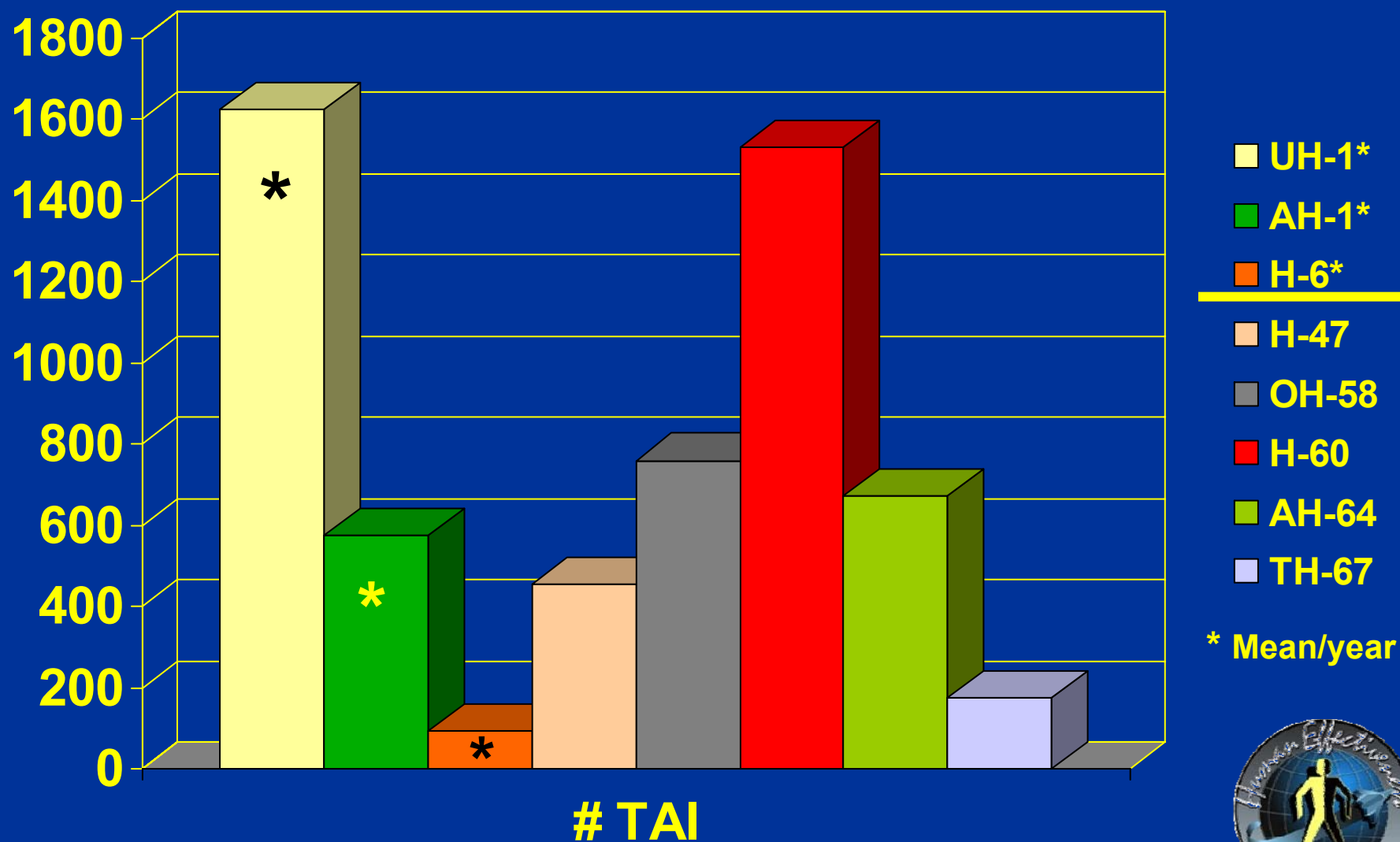


# Force Categorization





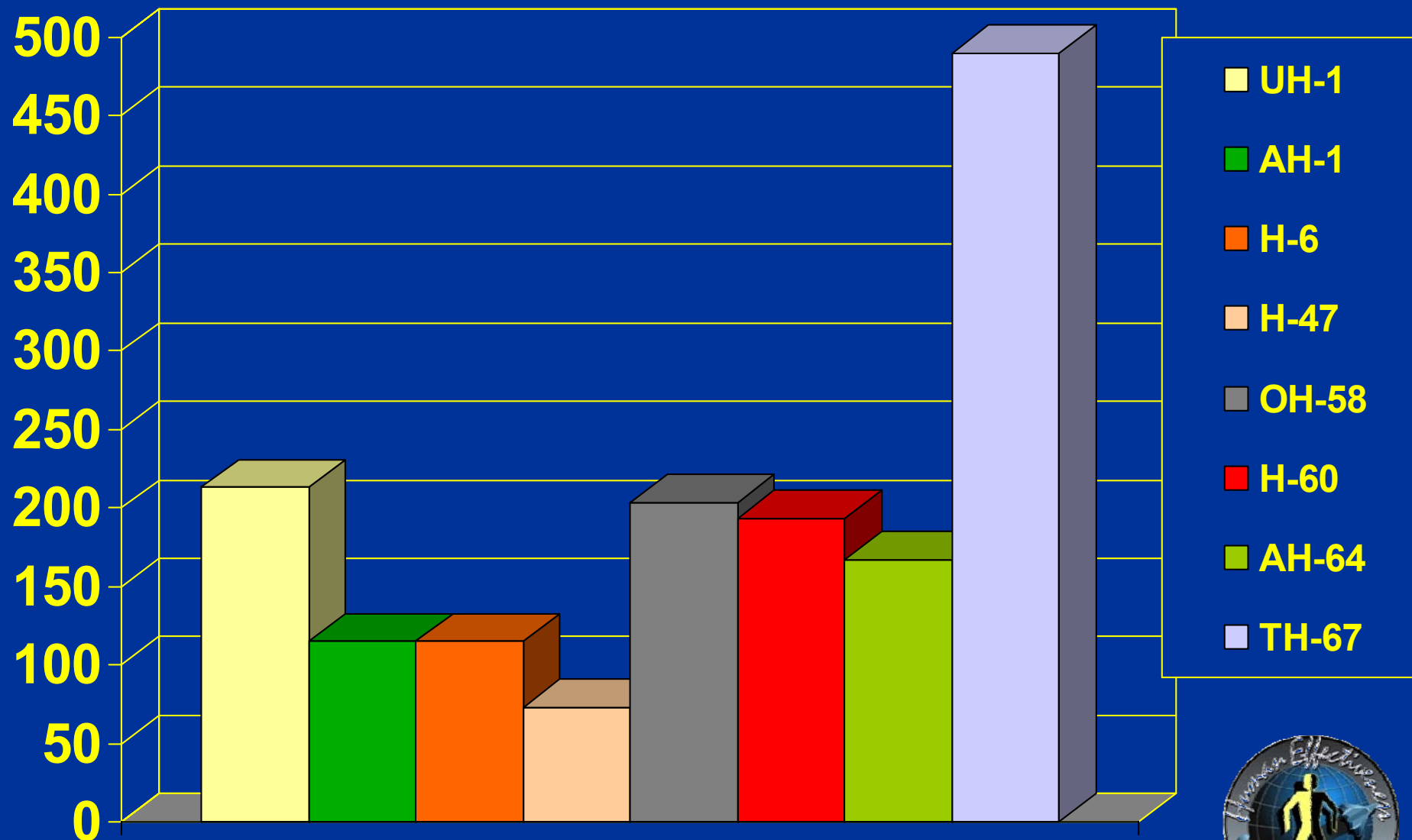
# Current Active Inventory or Average Active Inventory for FY 85 – 05







# Utilization Rates, Hours per Aircraft-Year, FY 85 – 05



Hours per Aircraft-Year



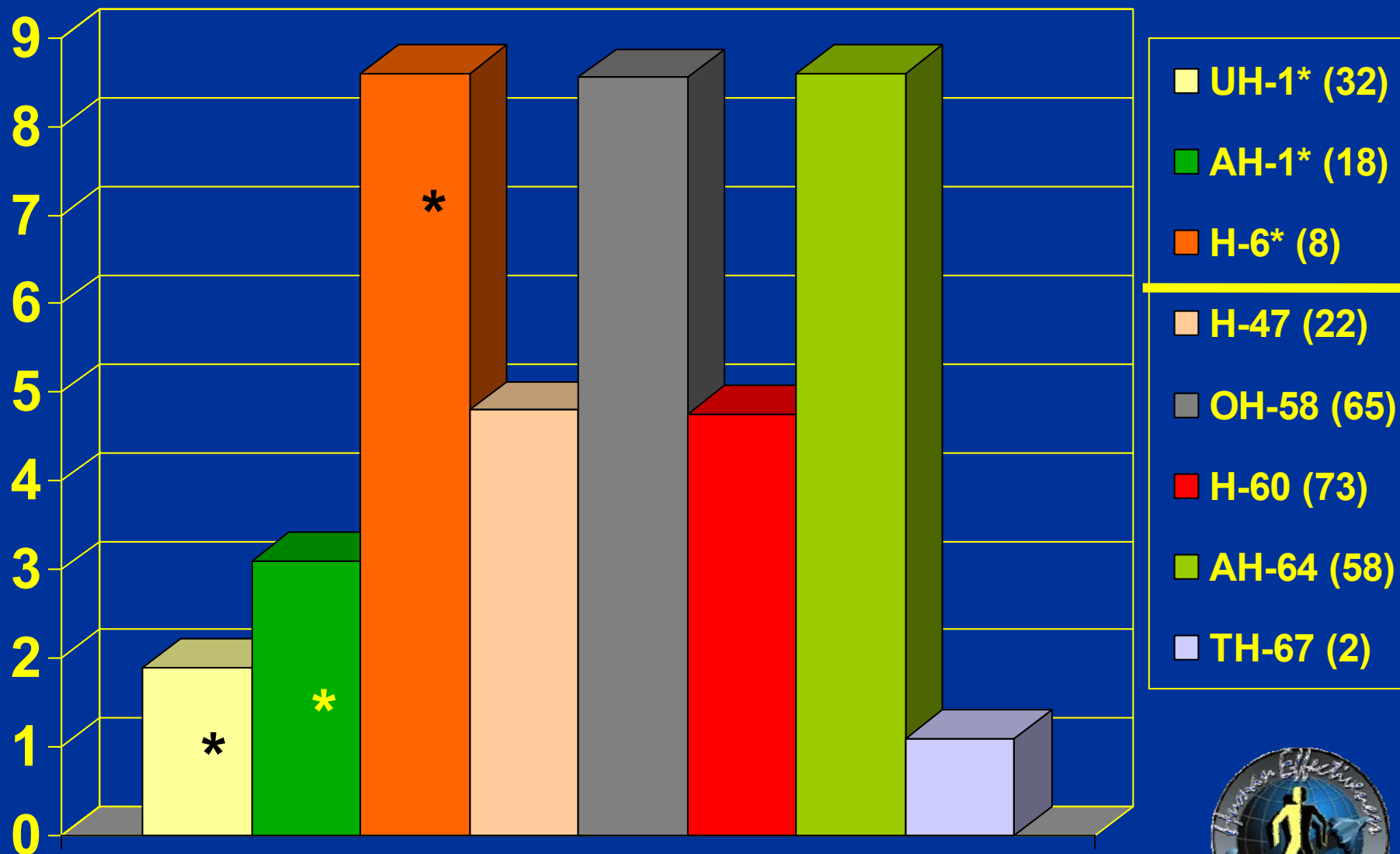


# Major Areas Of Mishaps, Loss Of Life & Injury





# % of Inventory, FY 85 – 05, Involved in Class A or B HF Mishaps



N = 278

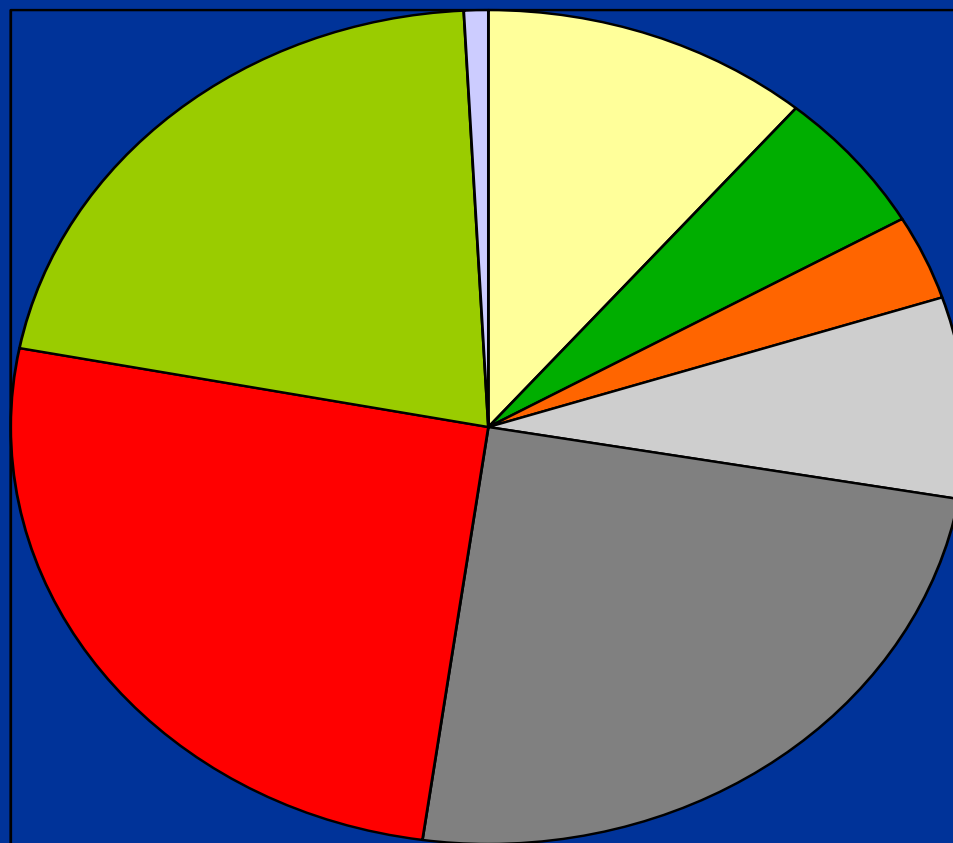
% Involved

\* = Average/21 yrs





# HF Mishaps by MDS



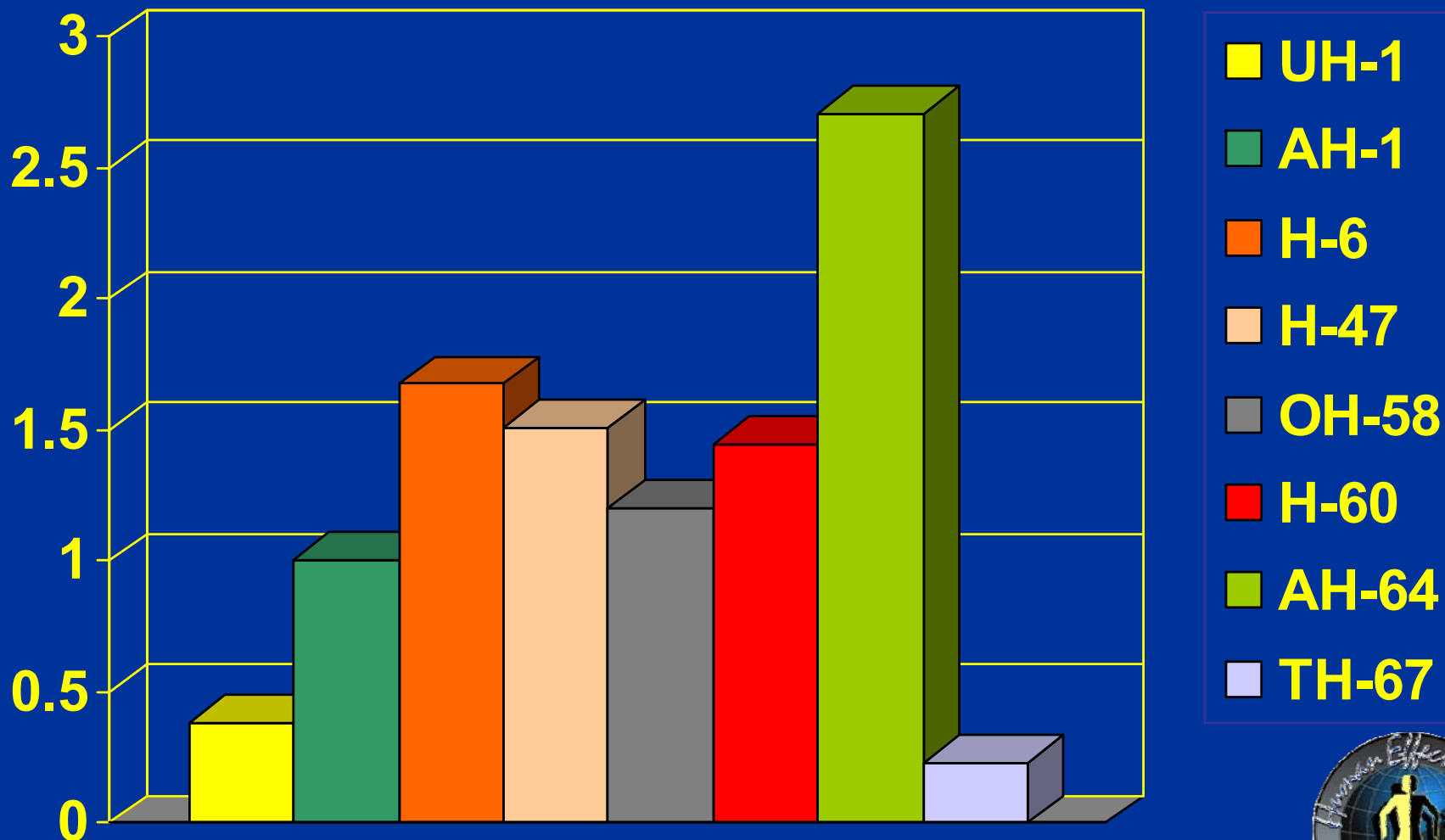
- UH-1 (28)
- AH-1 (14)
- H-6 (8)
- H-47 (20)
- OH-58 (61)
- H-60 (65)
- AH-64 (53)
- TH-67 (2)

N = 251



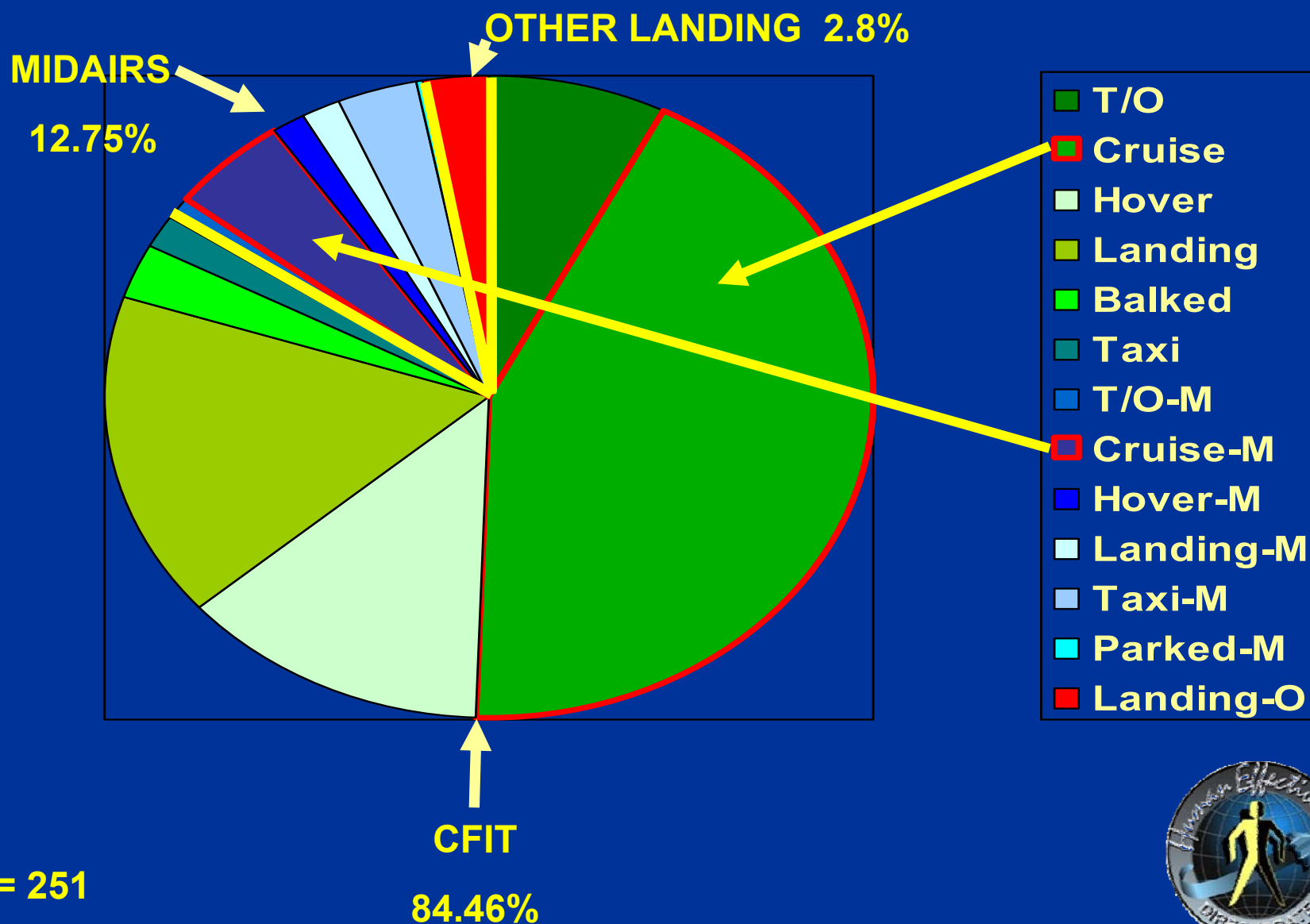


# HF Mishap Rates/100KHrs by MDS



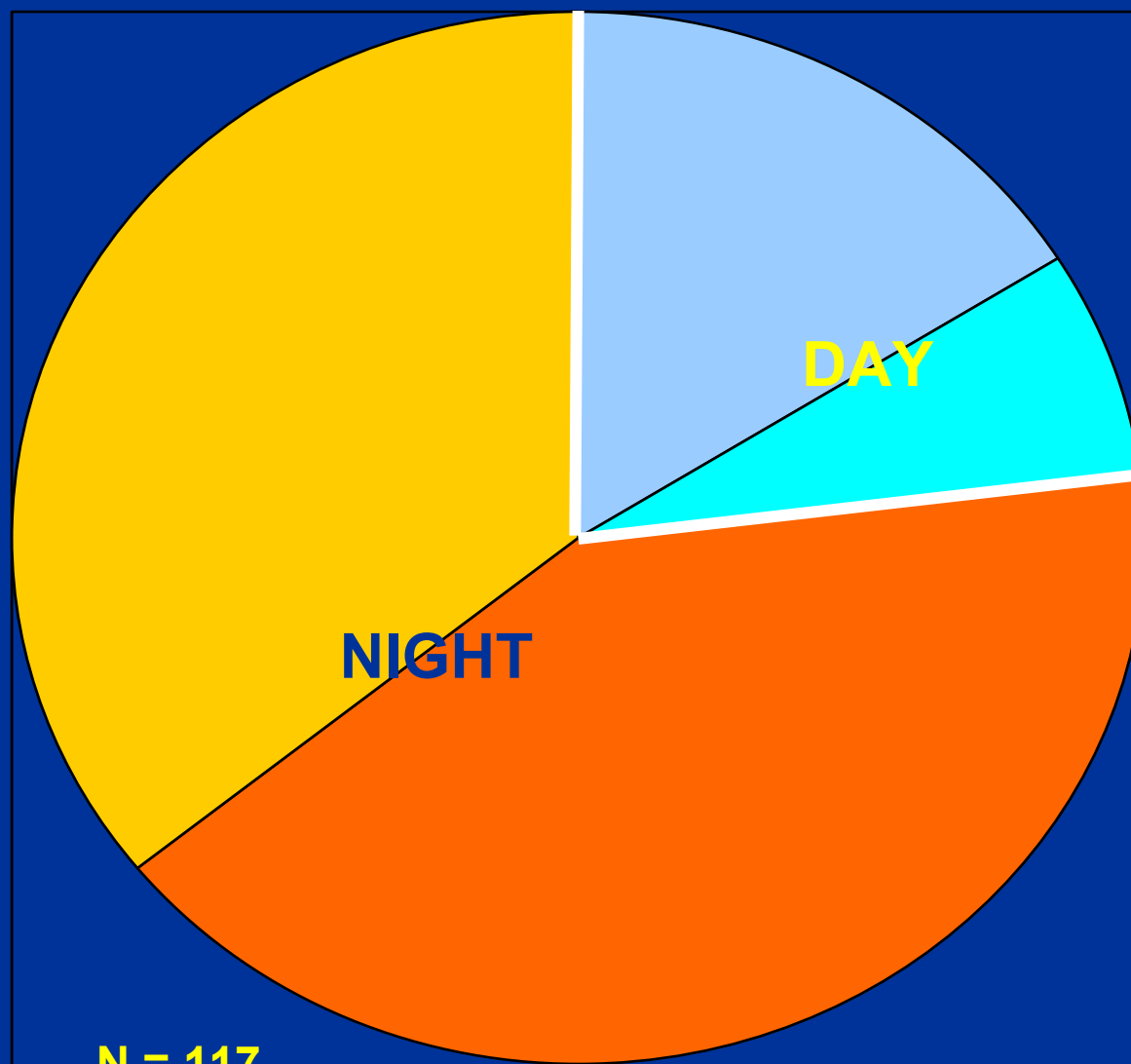


# HF Mishaps by Type & Phase





# HF White/Brownout (& v-I) Prone Conditions



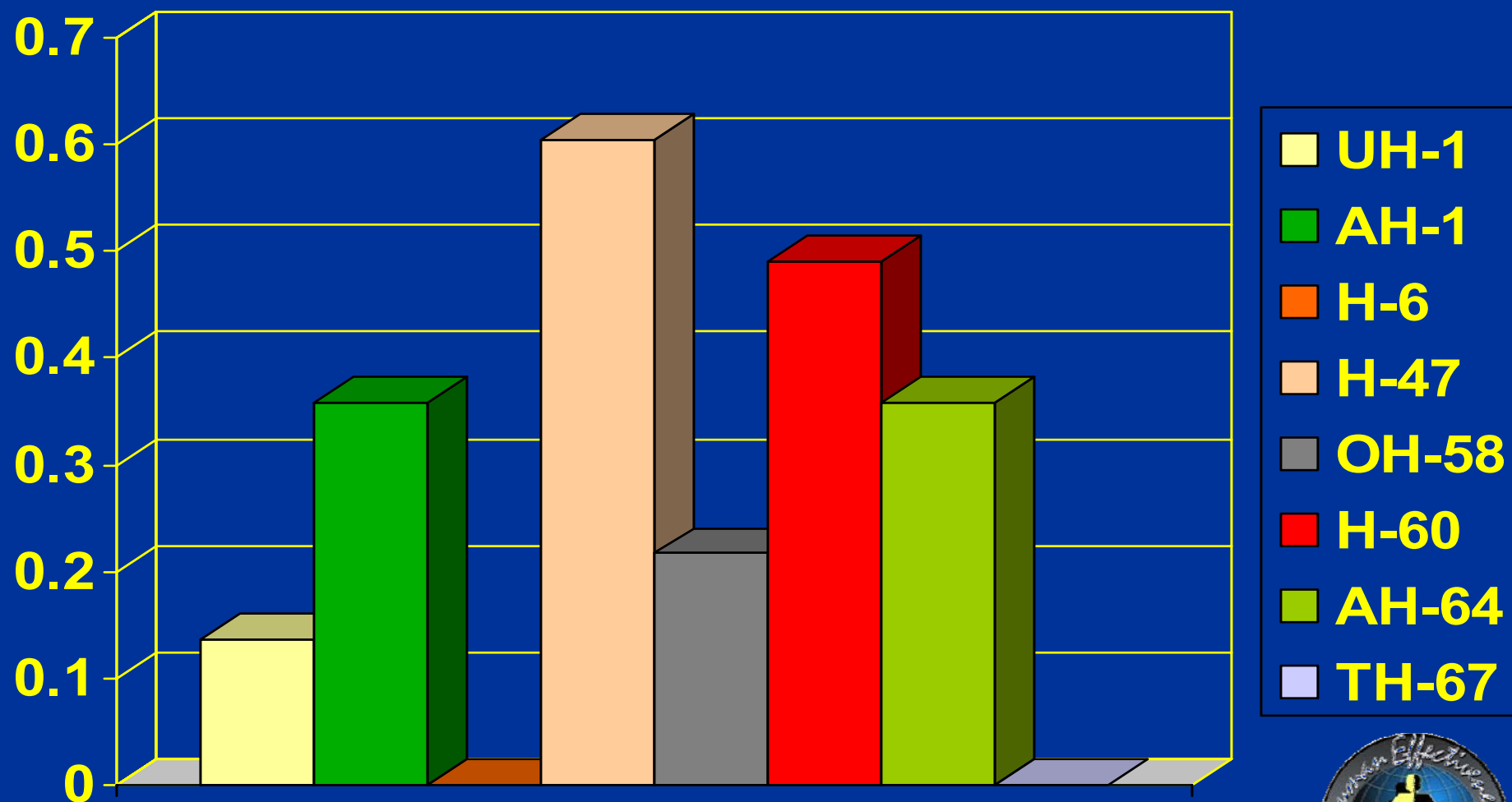
N = 117

- Day-Brownout
- Day
- Night-Brownout
- Night





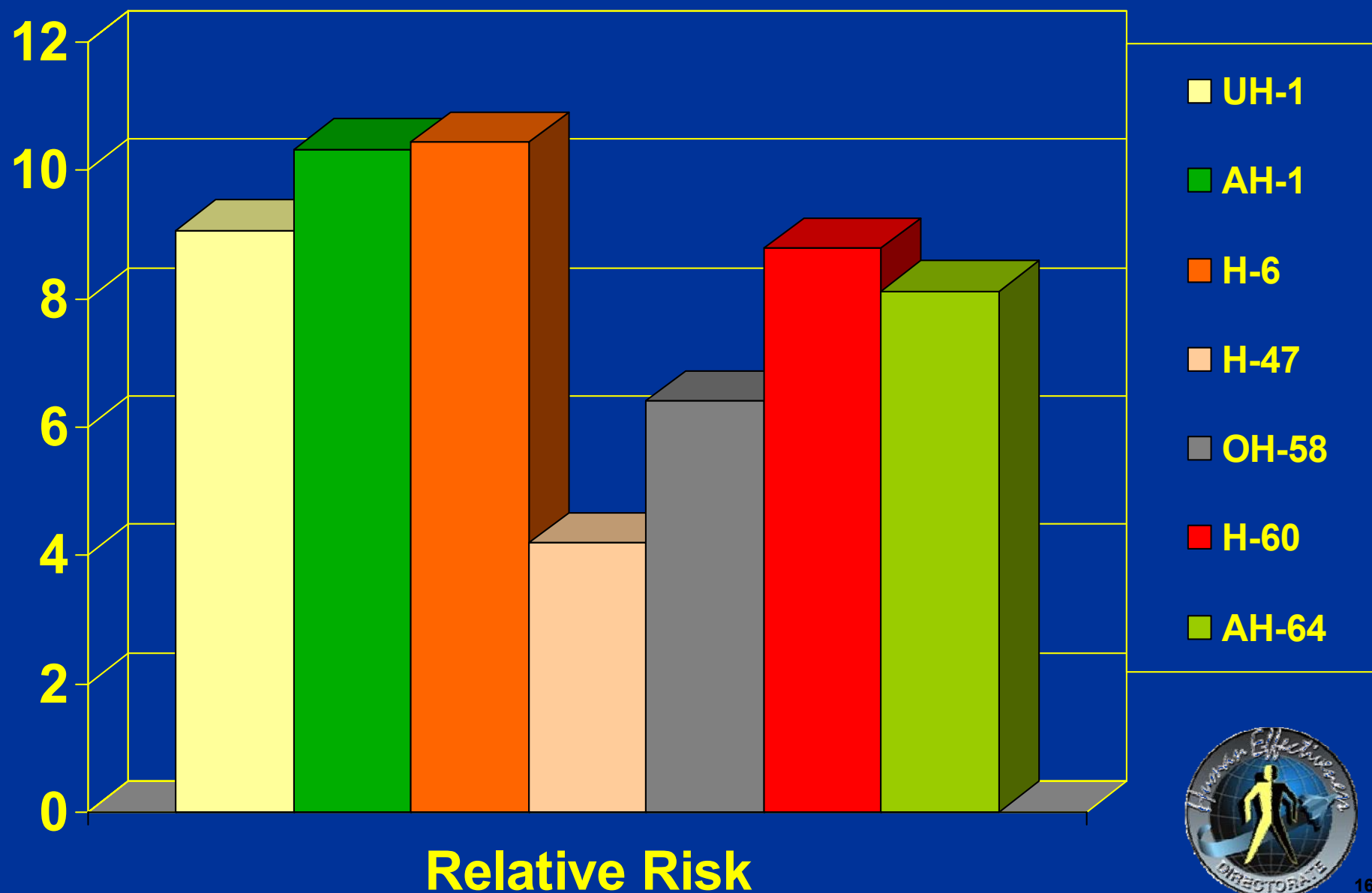
# HF WHITEOUT/BROWNOUT RATES (/100K Hours) BY SYSTEM







# Relative Risk of HF Mishaps at Night vs. Day, FY 85 – 05



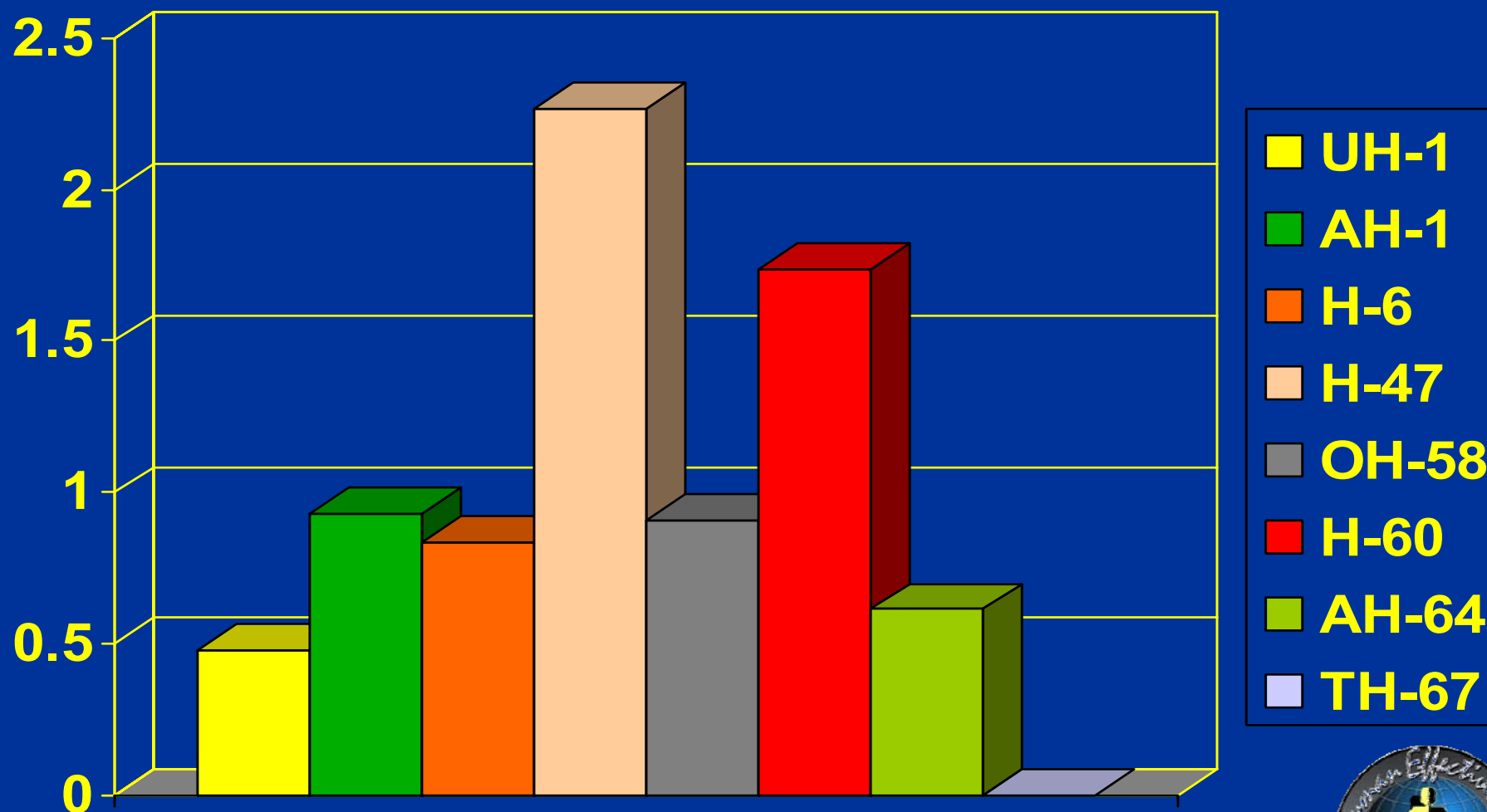


# Fatality & Injury Patterns



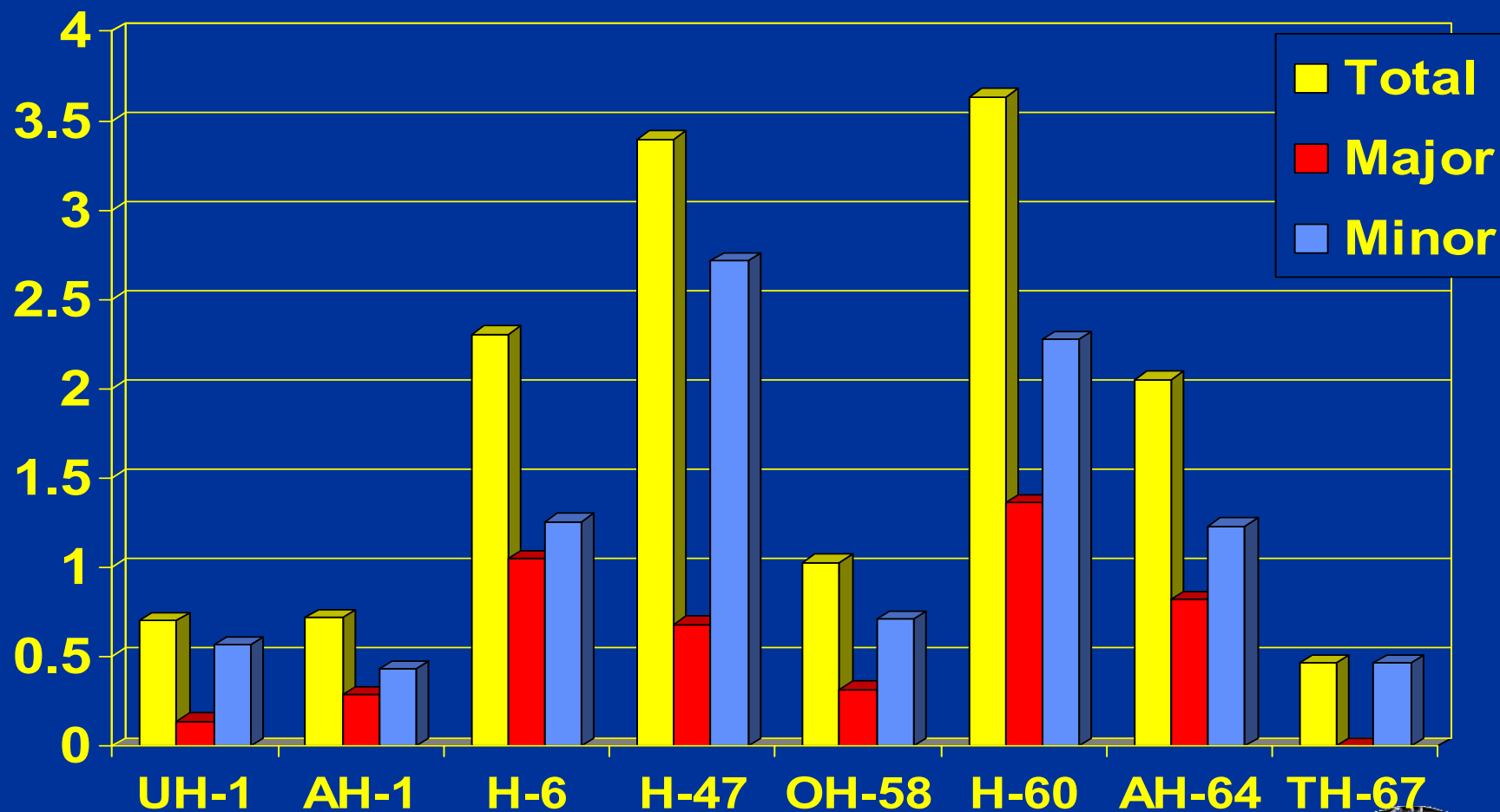


# HF Fatality Rates/100K Hours BY MDS



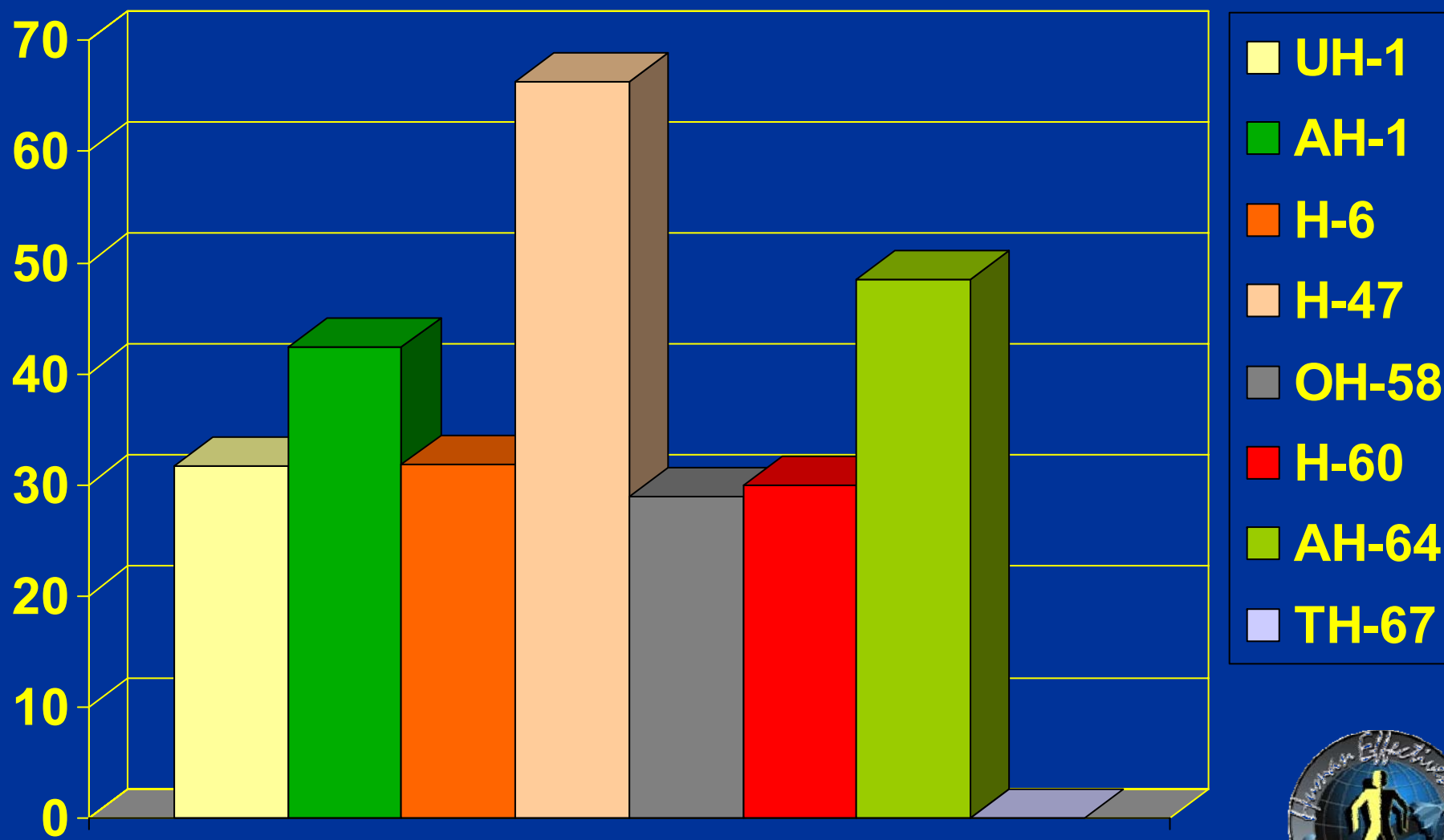


# HF Injury Rates/100K Hours By System



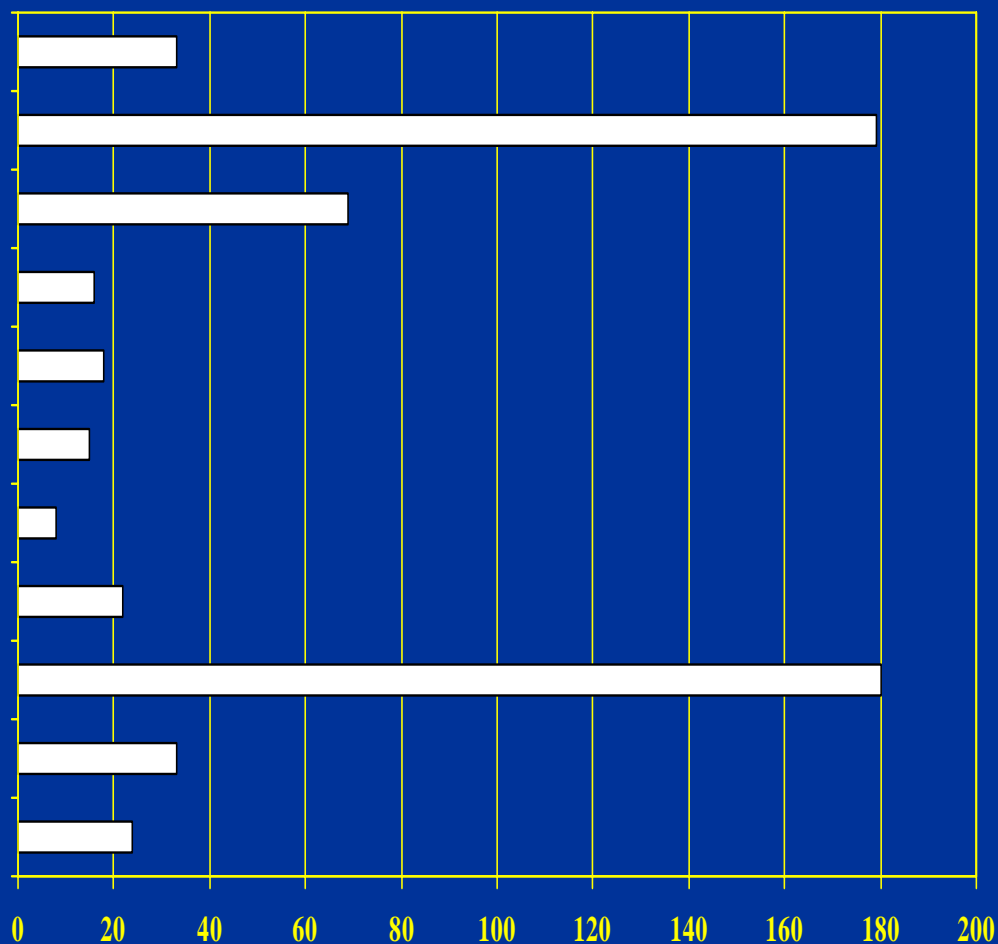


# HF Mishap Protection Factor

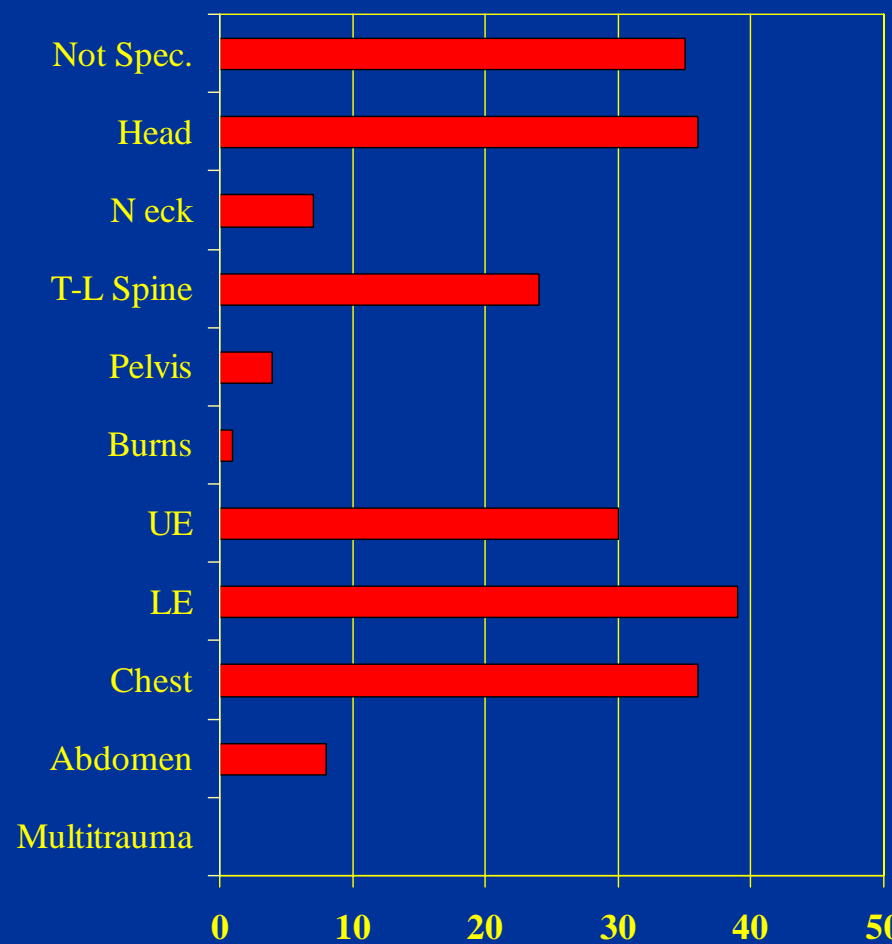




# U.S. Army Rotary Wing Human Factor Mishap Fatalities & Injuries



**FATAL** (N=230)



**MAJOR INJURY**

(N=140)





# Paired Pilot VS. Passenger & Crew

## U.S. Army Rotary Wing Human Factor Mishap Fatalities & Injuries



MISHAP N = 112 $p(X^2_{trend}) = .27$	PILOTS N = 232		PAX & CREW N = 431		$\Delta\%$ (p value)
	#	%	#	%	
NOT INJURED	88	37.9	140	32.5	- 5.4 (.159)
MINOR INJURY	67	28.9	113	26.2	-2.6 (.462)
MAJOR INJURY	22	9.5	70	16.2	+ 6.7 <u>(.016)</u>
DEAD	55	23.7	108	25.1	+ 1.4 (.699)



# Pilot vs. Passenger & Crew USA Non-HF Injuries & Fatalities



MISHAPS N = 207	PILOTS N = 409		PAX & CREW N = 315		$\Delta\%$
	#	%	#	%	
NOT INJURED	218	53.3	132	41.9	-11.4 RR = .77 (p<.0011)
MINOR INJURY	99	24.2	67	21.3	-2.9 RR = .89 (p<.388)
MAJOR INJURY	23	5.6	21	6.7	+1.04 RR = 1.2 (P<.538)
FATAL	69	16.9	95	30.2	+13.3 RR = 1.75 (P<.00006)



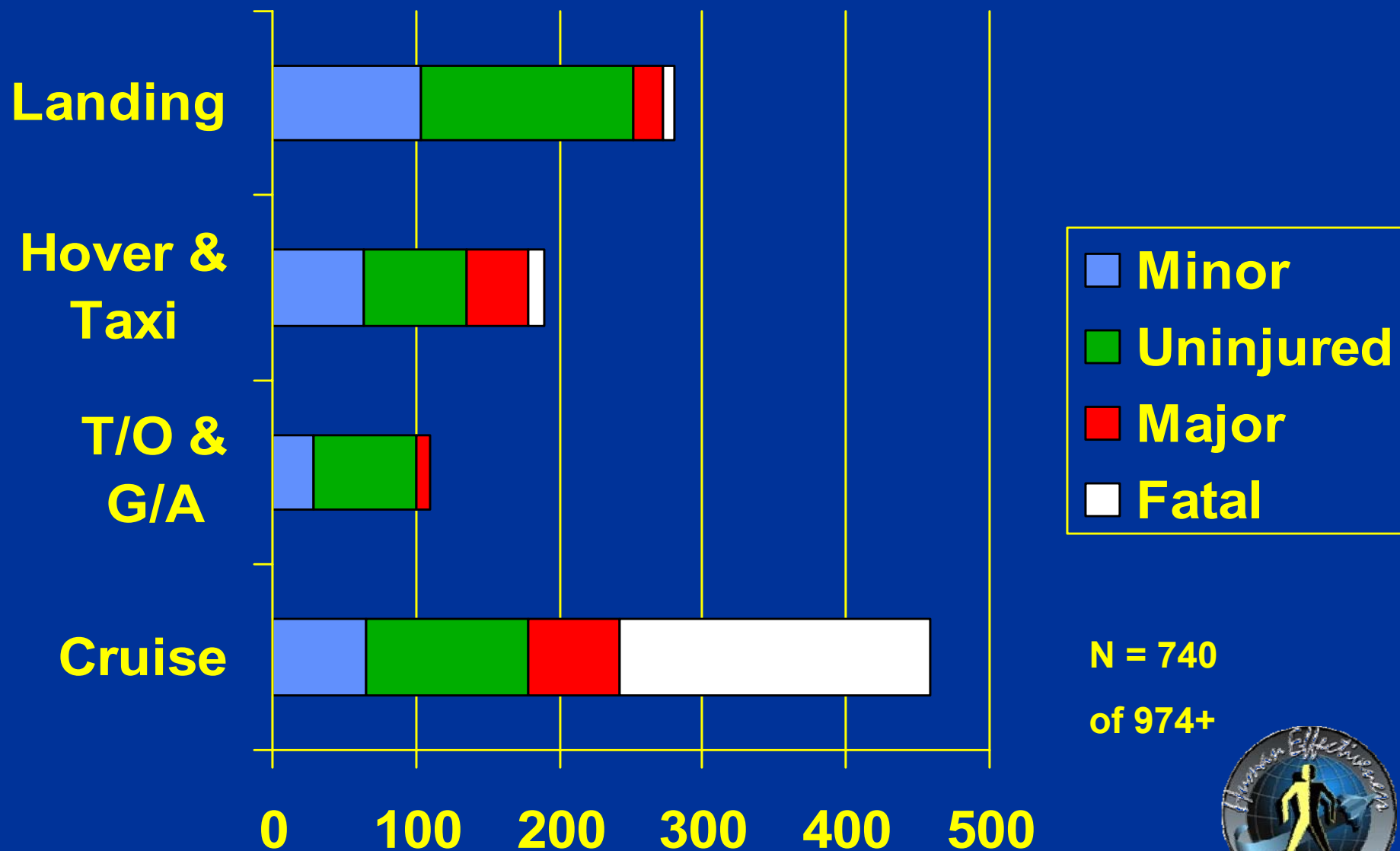


# Mishaps By Phase Of Flight



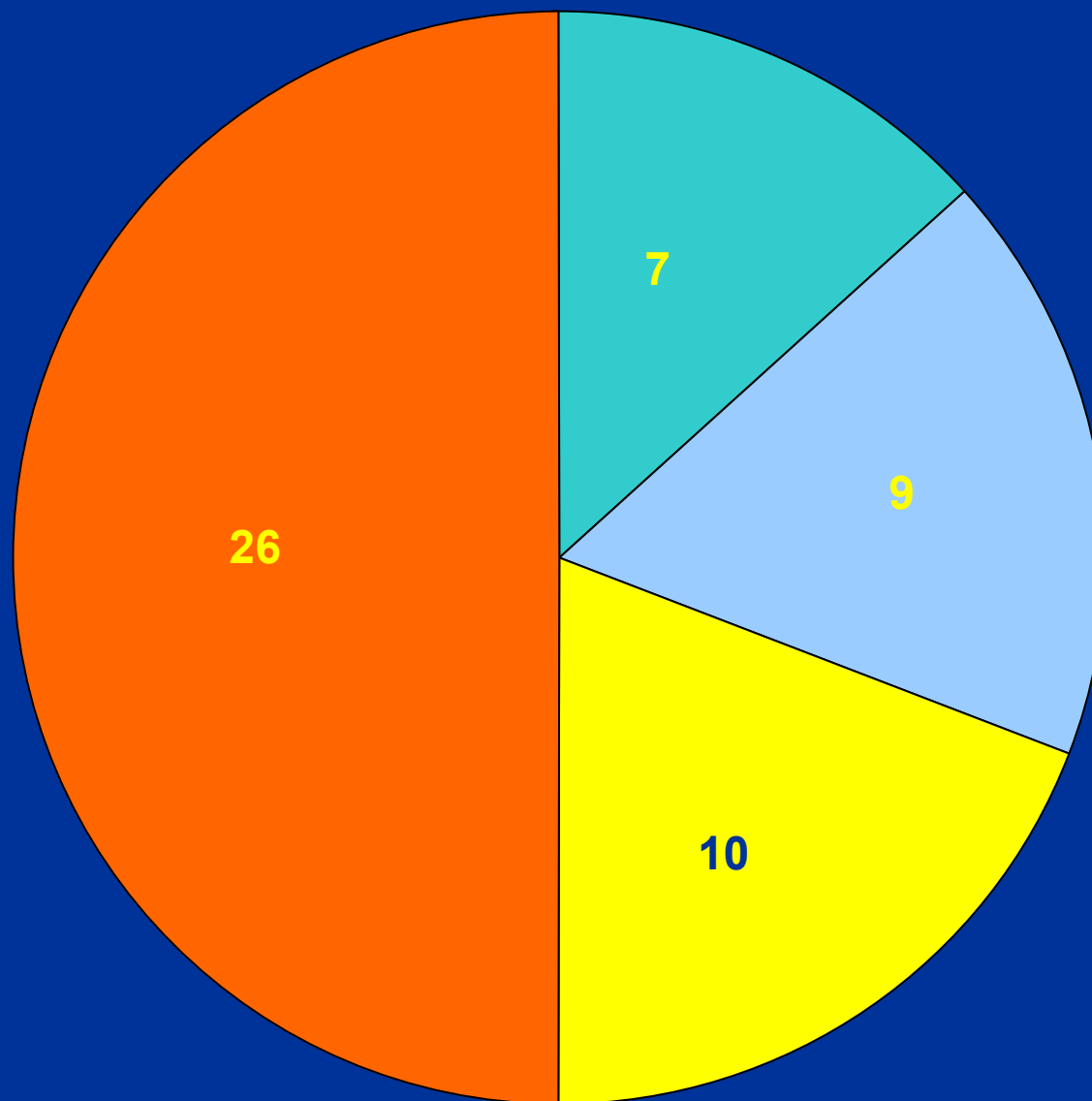


# HF Fatalities & Injuries by Phase OF Flight - Overview





# HF Landing Mishaps



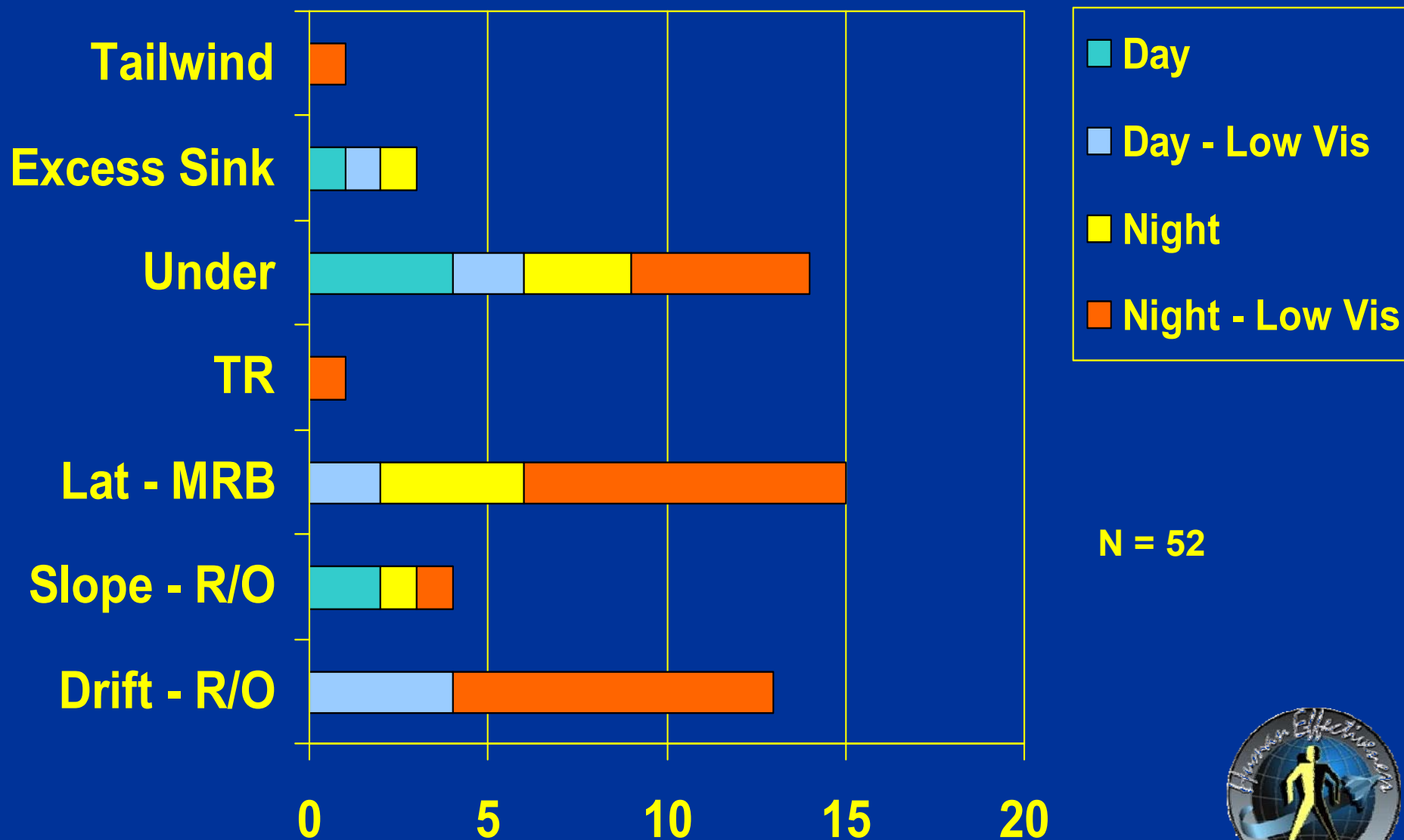
- Day
- Day - Low Vis.
- Night
- Night - Low Vis.

N = 52





# HF Landing Mishaps

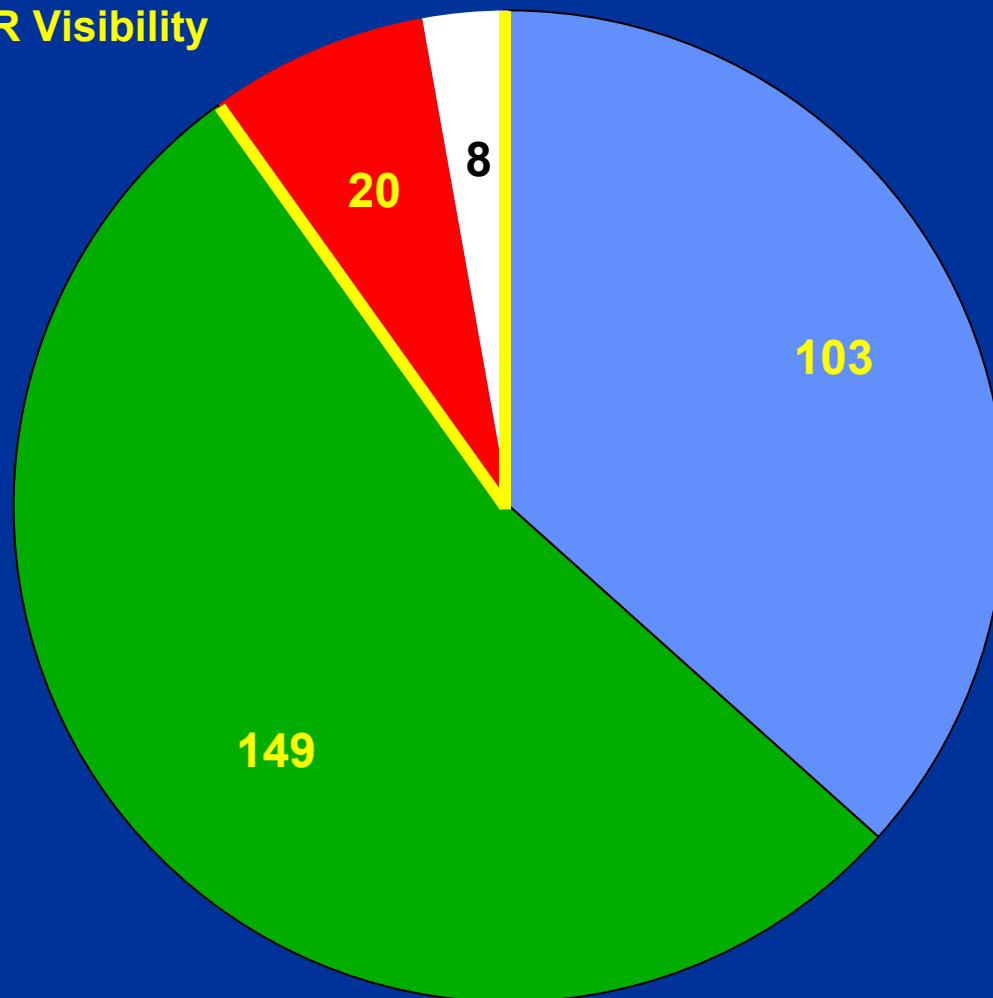




# HF Landing Fatalities & Injuries



All Fatalities and all major injuries except one occurred in B/O or IFR Visibility

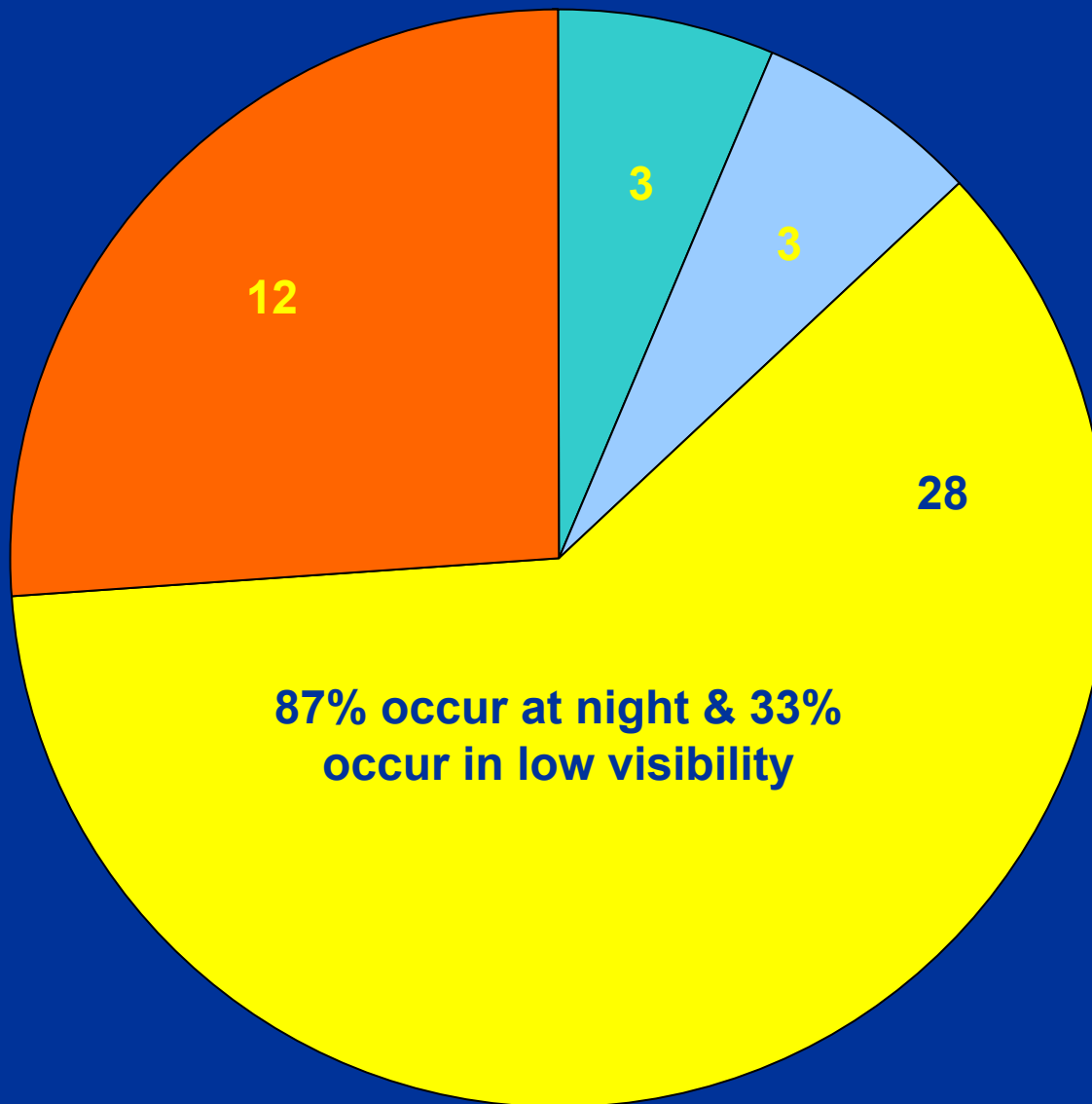


N = 280





# HF Hover/Taxi Mishaps



- Day
- Day - Low Vis.
- Night
- Night - Low Vis.

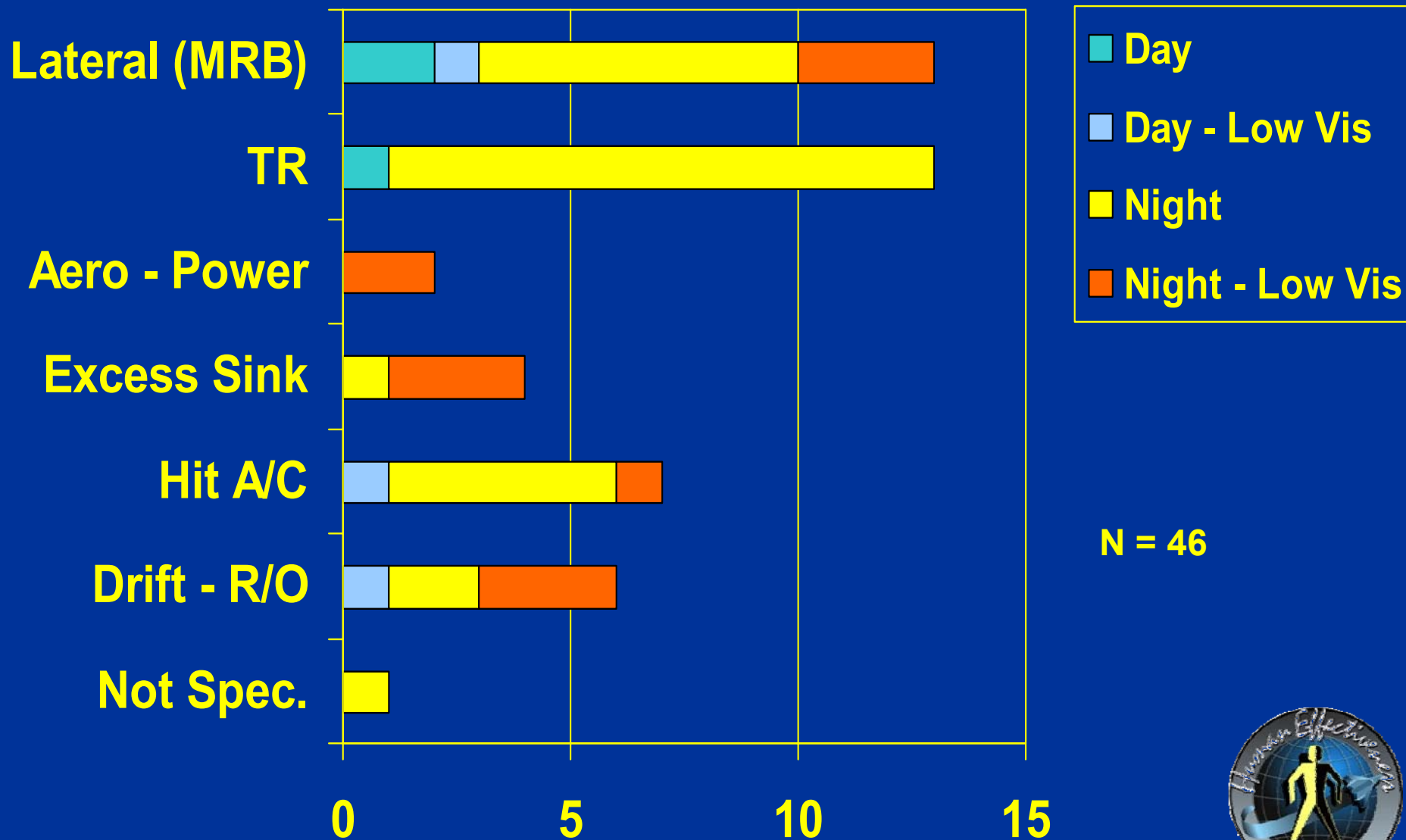
N = 46

87% occur at night & 33%  
occur in low visibility





# HF Hover/Taxi Mishaps

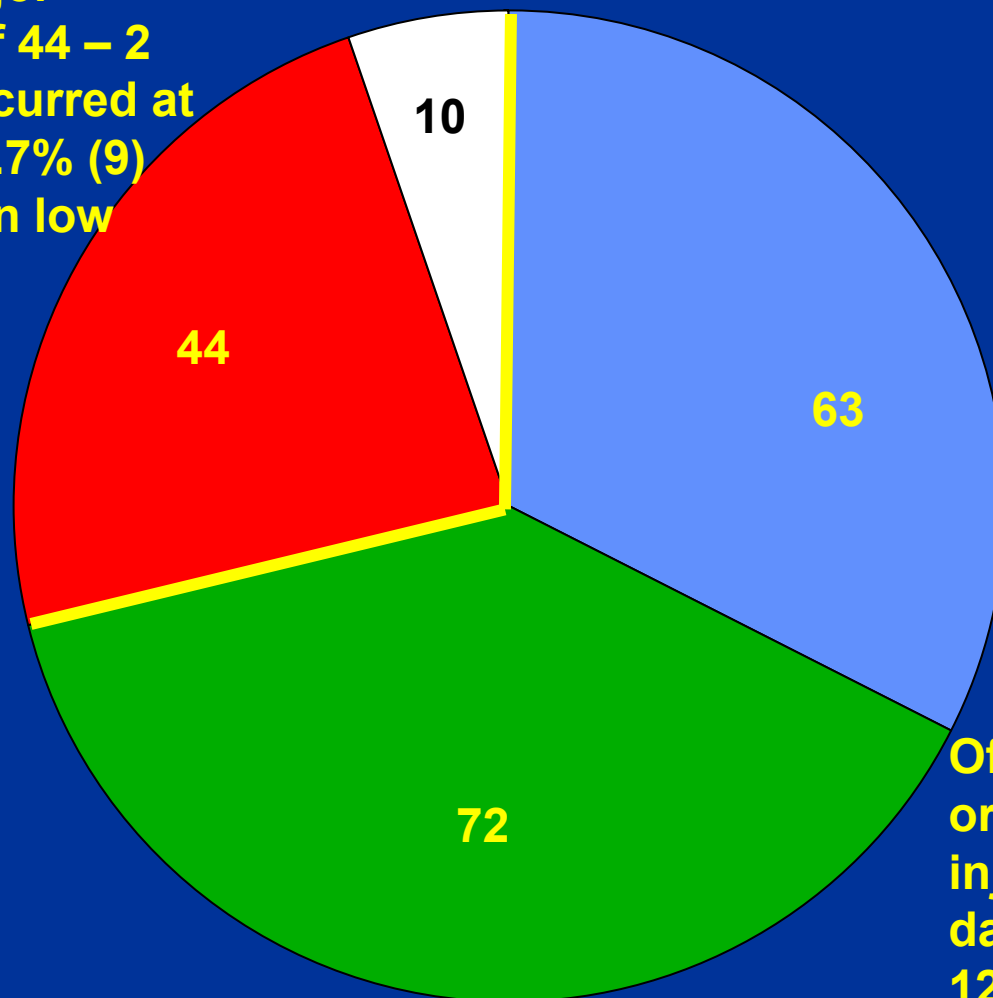




# HF Hover/Taxi Fatalities & Injuries



All Fatalities (10)  
and 42 Major  
Injuries (of 44 – 2  
undet.) occurred at  
night & 16.7% (9)  
occurred in low  
visibility



■ Minor  
■ Uninjured  
■ Major  
■ Dead

N = 189

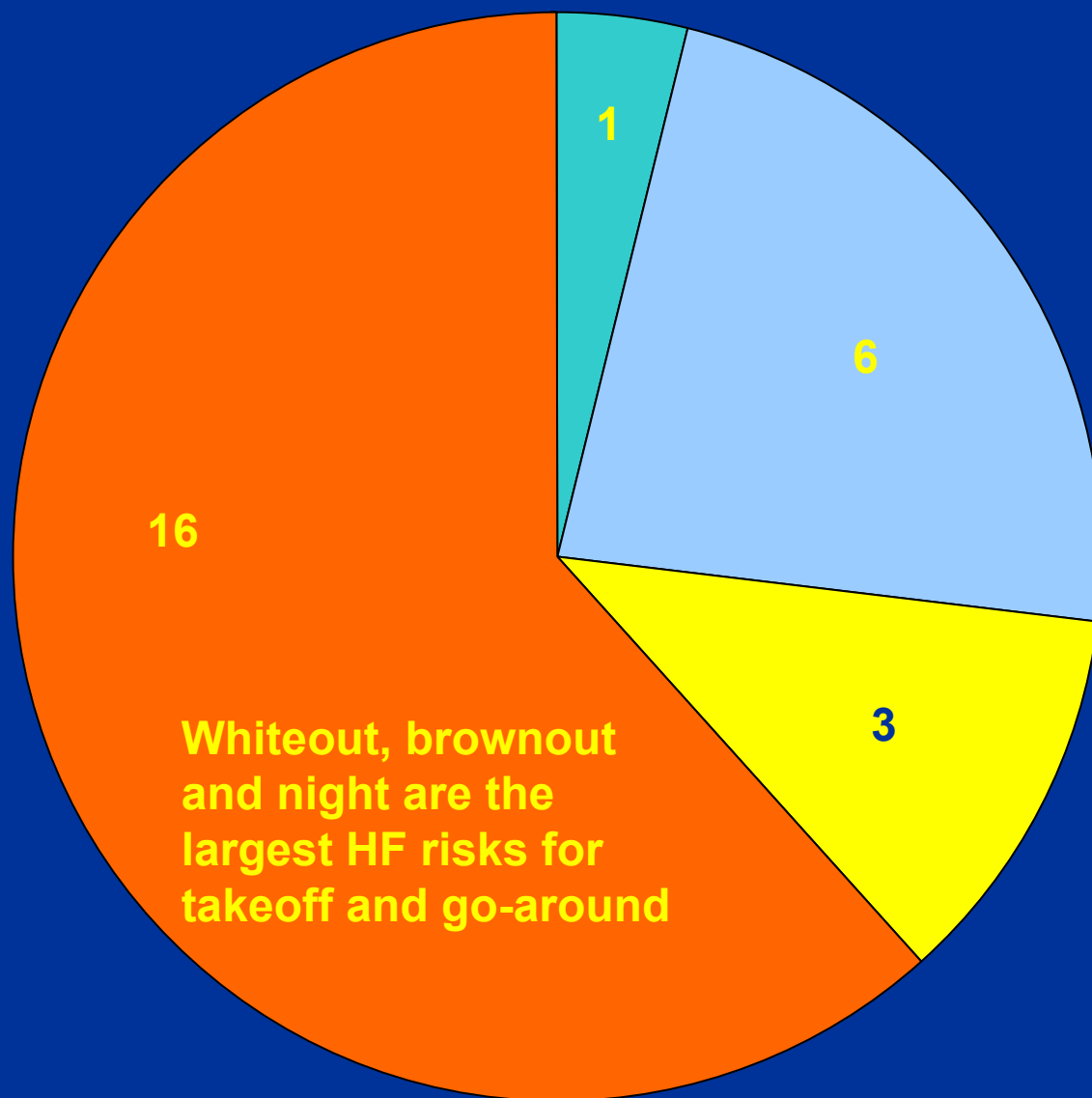
Of those uninjured  
or with minor  
injuries, 6 were  
day (3 low vis) and  
129 were night (3  
low vis)







# HF T/O & G/A Mishaps



- Day
- Day - Low Vis.
- Night
- Night - Low Vis.

N = 26





# HF T/O & G/A Mishaps



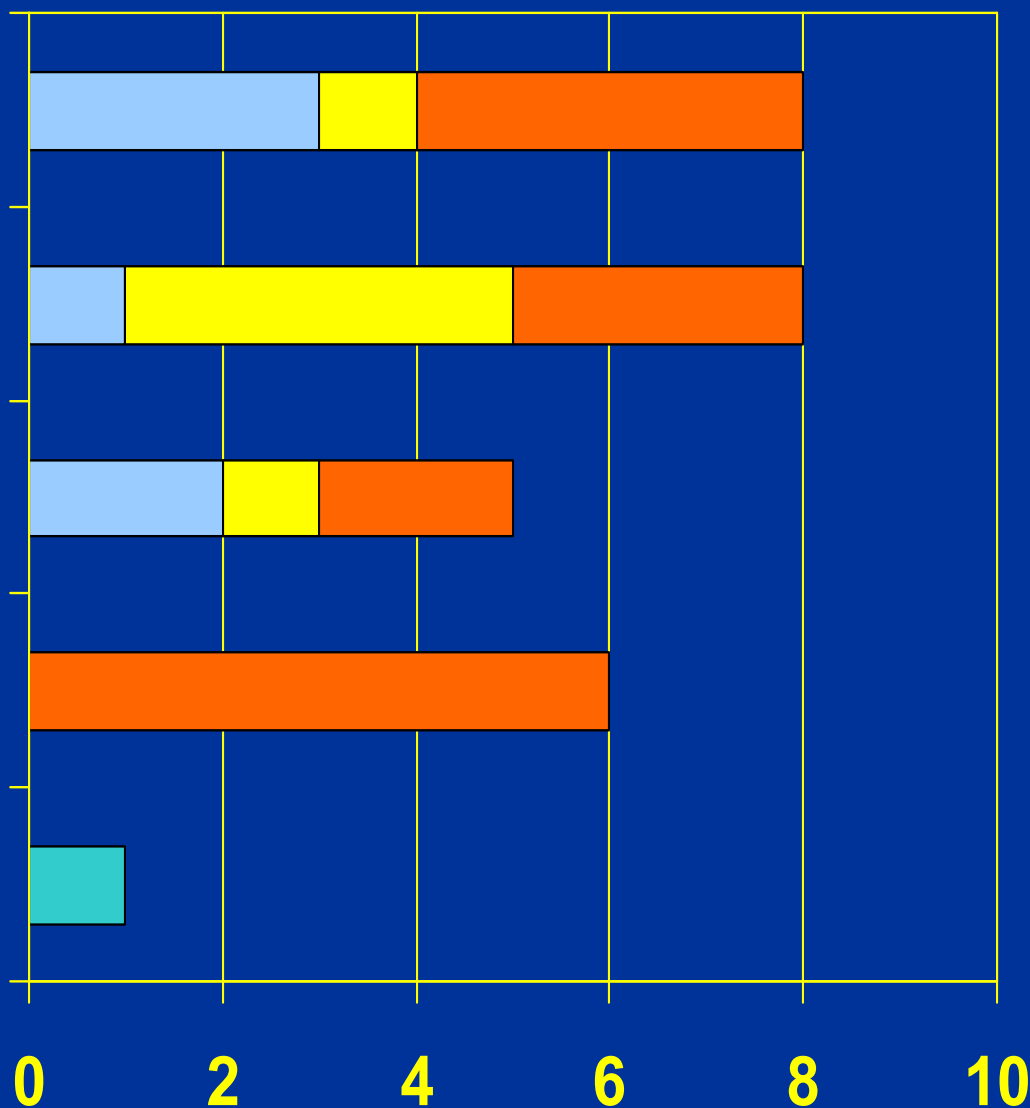
**Aero - PWR**

**Lat - A/C**

**Lat - MRB**

**Drift - R/O**

**Wire**



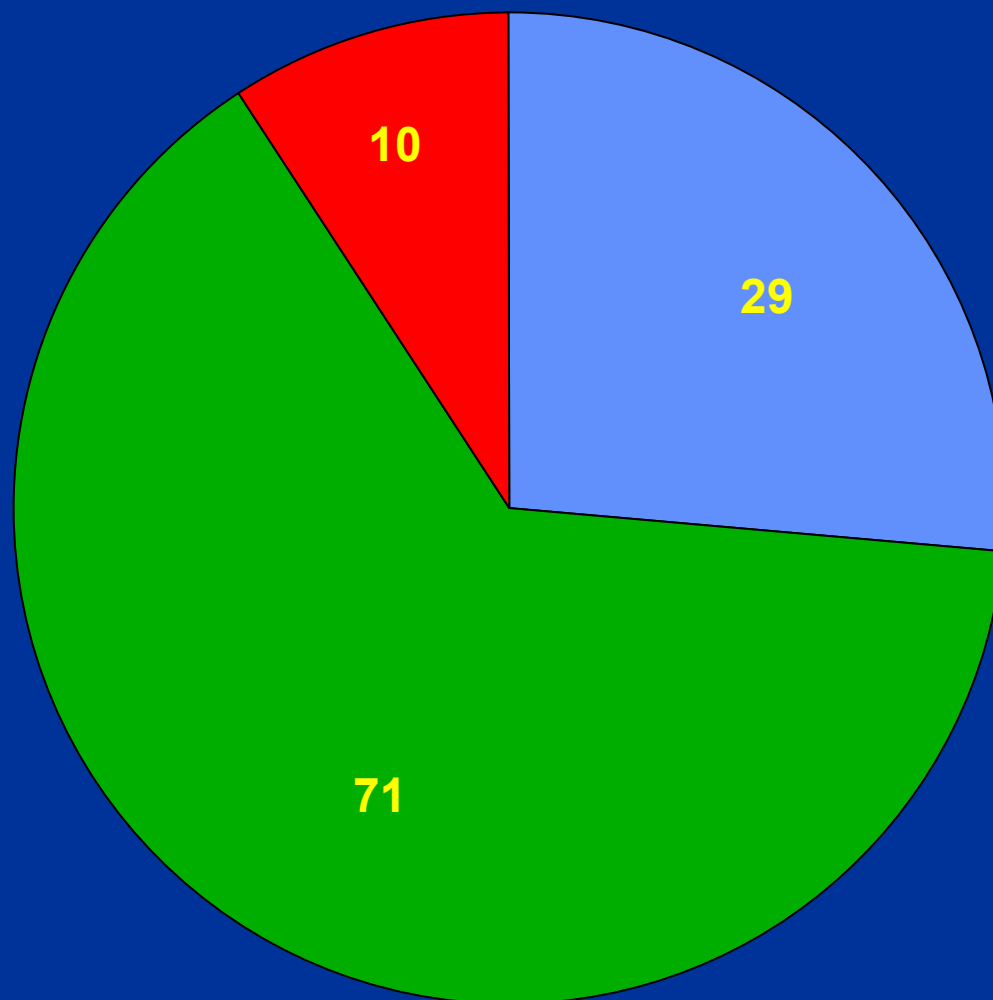
**N = 26**





# HF T/O & G/A Injuries

(NO HF FATALITIES OCCURRED DURING T/O & G/A)



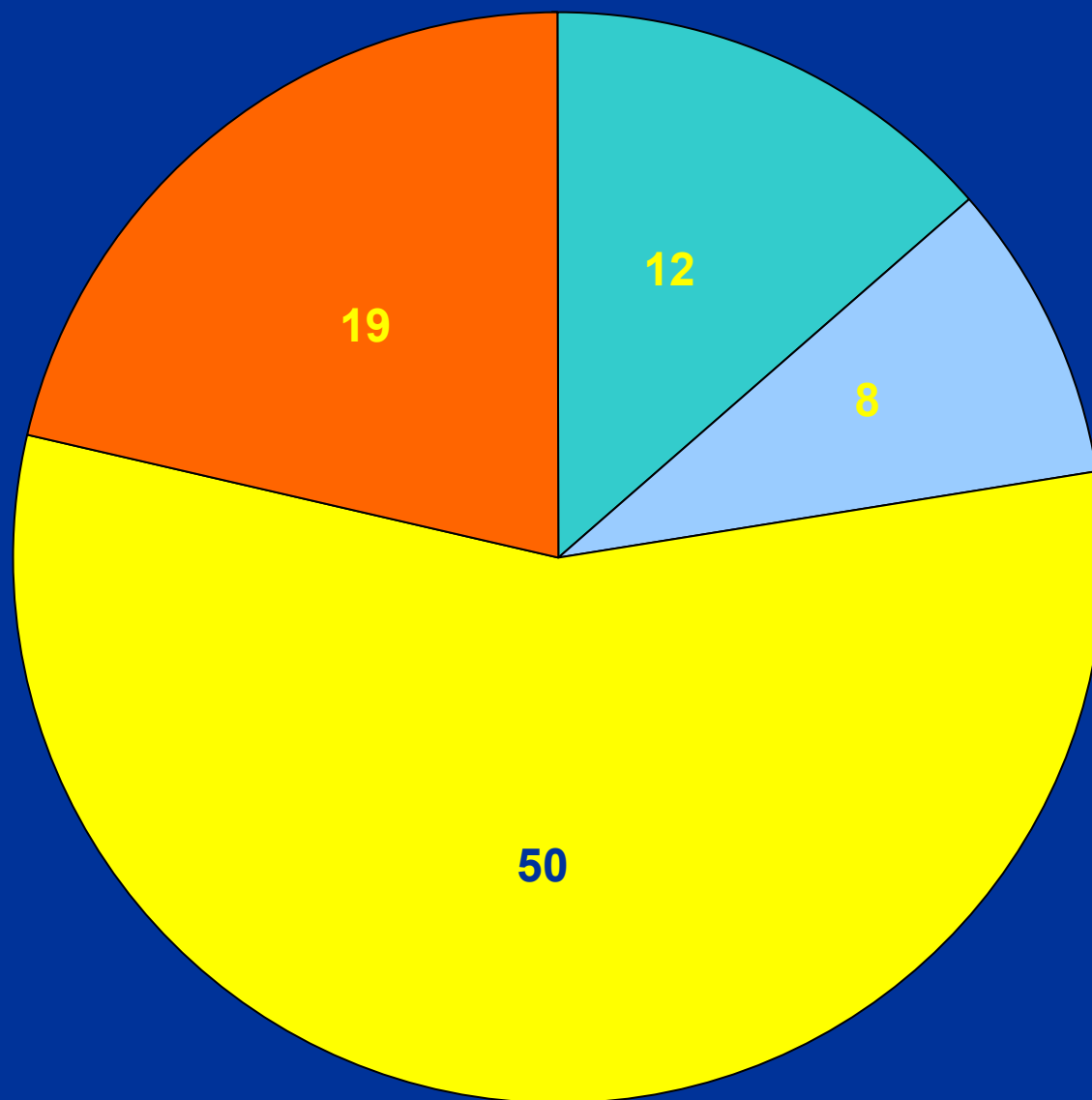
- Minor
- Uninjured
- Major

N = 110





# HF Cruise Mishaps



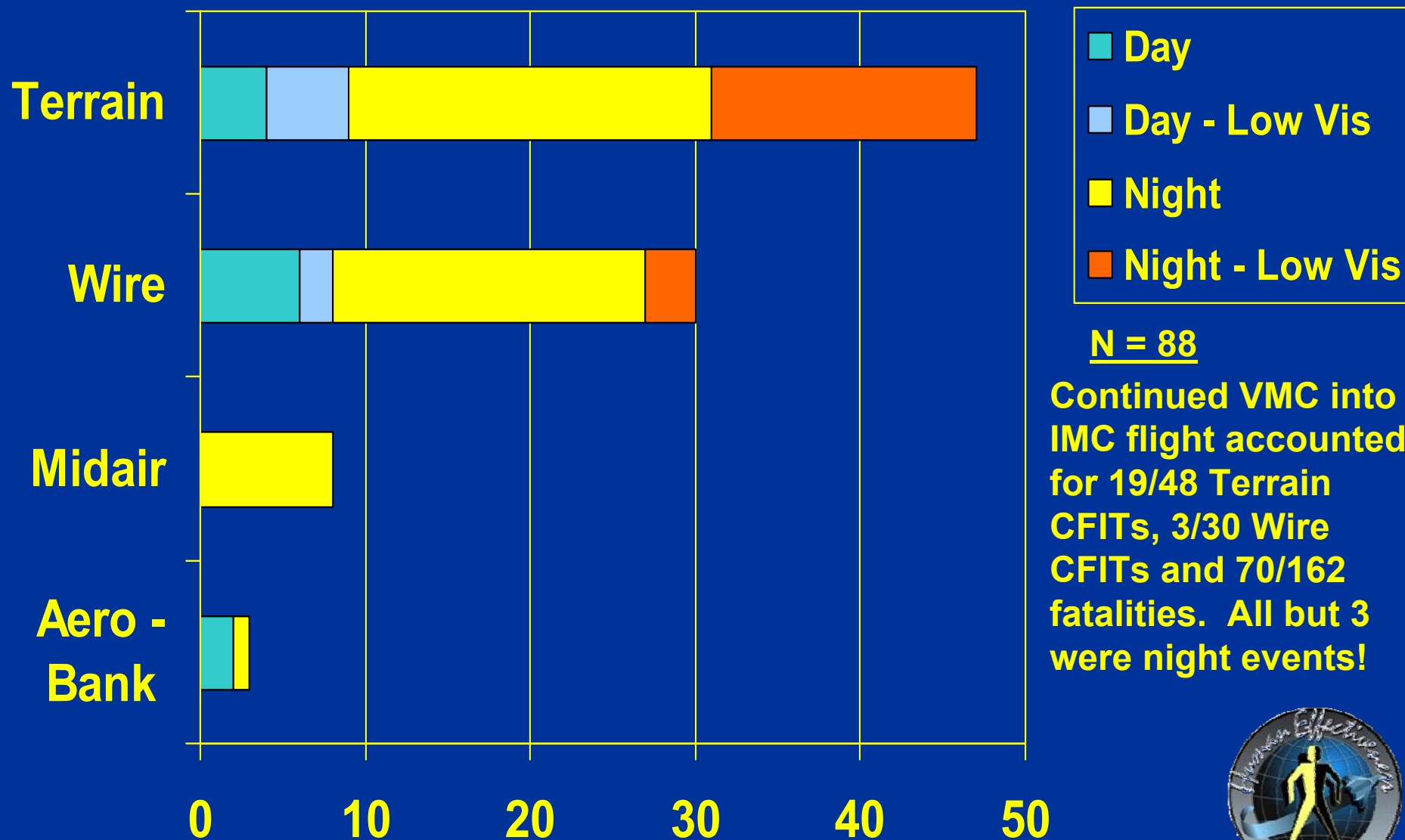
- Day
- Day - Low Vis.
- Night
- Night - Low Vis.

N = 88





# HF Cruise Mishaps

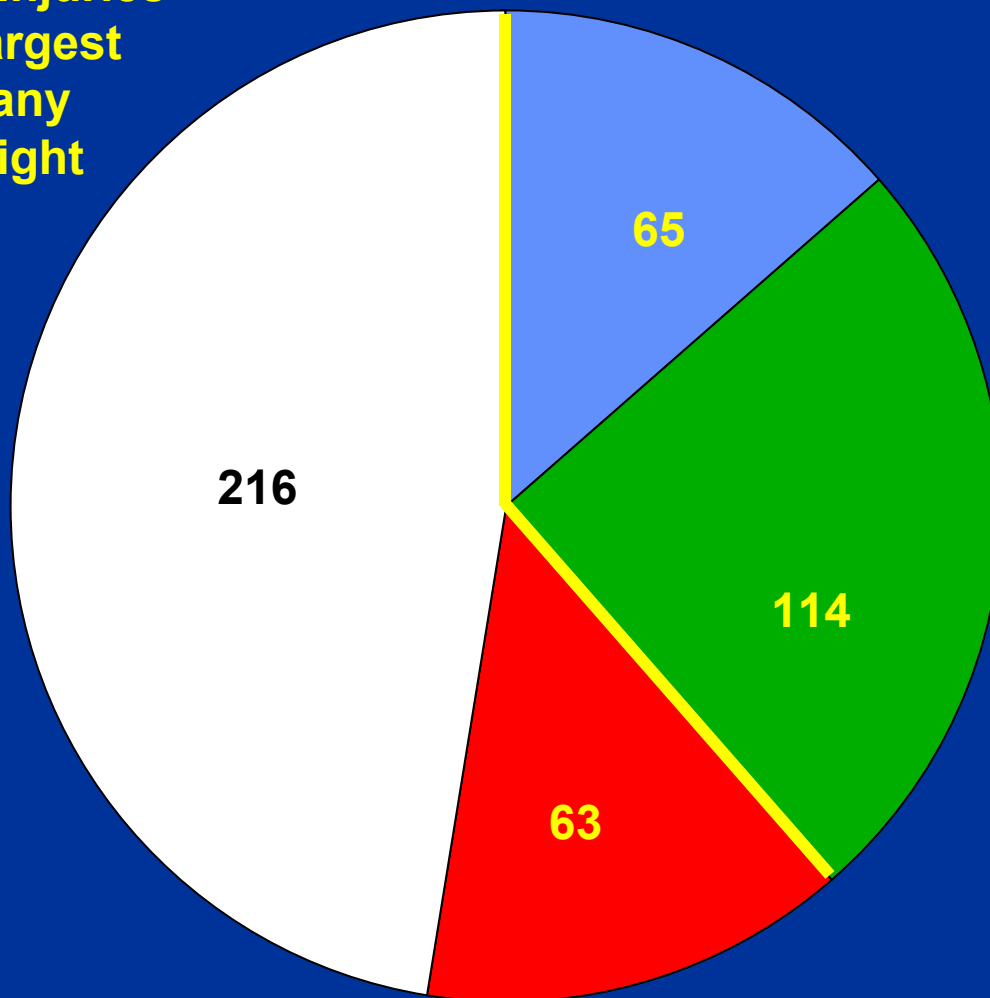




# HF Cruise Fatalities & Injuries



Cruise Fatalities and Major Injuries were the largest groups in any phase of flight



■ Minor  
■ Uninjured  
■ Major  
■ Dead

N = 458

Wire strikes accounted for 42/216 cruise fatalities and 22/63 major injuries

Midair collisions accounted for 50/216 cruise fatalities and 10/63 major injuries





# Mishaps By Airframe





# Comparison of Army Helicopters by Threats & Type



MDS	CFIT	MIDAIR	B/O	TR	Night
UH-1	X		X		X
AH-1	X	X	X		XXX
H-6	X				X
H-47	X		X		X
OH-58 A-C = D	X	X		X	XXX
H-60	X	X	X		XX
AH-64	X		X	X	X







# Recommendations





# Technology Recommendations (Life Saving)



- US Army Helicopters would benefit from a system similar to TAWS
  - Militarize a COTS item to provide this for legacy aircraft
  - Use Navy TAWS when computer present
- Bring datalink weather data into the cockpit
- Provide COTS traffic warning technology to prevent midairs
- All helicopters need wire detection technology
- All occupants should use lap and shoulder restraints
- Airbag use should be evaluated
- Crew positions should be designed to eliminate (minimize) the need for any crewmember to be out of a crashworthy seat below ETL
- All helicopter occupants should be carried in crashworthy seats capable of Gz mitigation with 4-point restraint





# Technology Recommendations (Aircraft Saving)



- All helicopters need technology permitting safe flight and the maintenance of situational awareness in brownout/whiteout conditions, particularly at night:
  - Automated hover with instant availability
  - Automated landing systems
  - Sensor based systems
- All helicopters without rearward visibility (AH & OH) should be equipped with technology to prevent tail rotor strikes:
  - Warning systems that notify the pilot when an object is in the proximity of the tail rotor.
  - Automated systems permitting hover in a fixed position without drift.





# Policy Recommendations



- No person should be allowed aboard an operating helicopter without wearing a helmet at all times
- All occupants should remain strapped in position when the vehicle is operated below ETL until it has landed or achieved a stabilized hover
- Combat operations may need exceptions to above
- VFR training should cease in IMC for all pilots
  - High Risk Mission, approve at O-6 level
  - Supervisors should actively recall or direct the landing of any assets airborne on VFR missions if weather is forecast to fall below VMC or does
  - Capable aircraft/pilots should use IFR clearances
- Emphasis should be placed on IMC proficiency



# Initiatives



- Occupant Protection
  - Navy SBIR on crashworthy passenger seating
  - ARMY Airbags in OH-58 (No stroking seat)
    - STWG white paper commissioned
  - Air Force
    - SBIR on localizing crew functions in back
    - SBIR on crashworthy crew seating
    - SBIR on crashworthy passenger seating
- Terrain, weather & traffic awareness
  - DSOC Dem/Val program with GPS based data
  - Tri-Service





# Needed



- Radar Wire Detection
- Tail Warning and/or automated hover for OH & AH aircraft (no rear visibility)
- Wireless Intercom for aft compartment crew
- Collection of adequate data for analysis by all services
  - Night hours by year and aircraft type
  - Instrument hours by year and aircraft type
  - Phase of flight exposure data (MFOQA)
    - Time in various altitudes & flight regimes
    - Man years of exposure
  - Mishap data (MFOQA)
  - Recommend Joint Analysis Center (USUHS)





The material in this presentation represents the opinion of the author and should not be construed to represent the position of the United States Air Force, the Department of Defense or any other organization.

# Questions?

Colonel Pete Mapes  
DUSDR/PR&A  
(703)604-0482

